



US010649233B2

(12) **United States Patent**  
**Miller et al.**

(10) **Patent No.:** **US 10,649,233 B2**

(45) **Date of Patent:** **May 12, 2020**

(54) **UNOBTRUSIVE EYE MOUNTED DISPLAY**

(71) Applicant: **Spy Eye, LLC**, Los Gatos, CA (US)

(72) Inventors: **Gregory David Miller**, San Jose, CA (US); **Brian Elliot Lemoff**, Morgan Hill, CA (US); **Kuang-mon Ashley Tuan**, Mountain View, CA (US); **Herbert John Kniess**, San Jose, CA (US); **Ion Opris**, San Jose, CA (US); **Michael West Wiemer**, San Jose, CA (US); **Drew Daniel Perkins**, Saratoga, CA (US)

(73) Assignee: **Tectus Corporation**, Saratoga, CA (US)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 112 days.

(21) Appl. No.: **15/822,913**

(22) Filed: **Nov. 27, 2017**

(65) **Prior Publication Data**

US 2018/0149884 A1 May 31, 2018

**Related U.S. Application Data**

(60) Provisional application No. 62/427,078, filed on Nov. 28, 2016.

(51) **Int. Cl.**  
**G02B 27/01** (2006.01)  
**G03B 21/14** (2006.01)

(Continued)

(52) **U.S. Cl.**  
CPC ..... **G02C 7/04** (2013.01); **G02B 27/01** (2013.01); **G02B 27/017** (2013.01); **G03B 21/14** (2013.01);

(Continued)

(58) **Field of Classification Search**

CPC combination set(s) only.

See application file for complete search history.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,871,247 A 10/1989 Haynes  
5,331,149 A 7/1994 Spitzer et al.  
(Continued)

**FOREIGN PATENT DOCUMENTS**

CA 2280022 1/2001  
WO WO 2016/014118 1/2016  
(Continued)

**OTHER PUBLICATIONS**

Kao, H-L. et al., "DuoSkin: Rapidly Prototyping On-Skin User Interfaces Using Skin-Friendly Materials," ISWC '16, ACM, Sep. 12-16, 2016, 8 pages.

(Continued)

*Primary Examiner* — Ganiyu A Hanidu

(74) *Attorney, Agent, or Firm* — Fenwick & West LLP

(57) **ABSTRACT**

An unobtrusive augmented reality (AR) system can be used to assist the wearer in every day interactions by projecting information from the contact lens display onto the retina of the wearer's eye. The unobtrusive augmented reality system includes a necklace and a contact lens display that are unobtrusive to the wearer and the wearer's surrounding environment. The necklace of the unobtrusive augmented reality system generates power and data for the contact lens displays. The necklace and contact lens display include conductive coils inductively coupled by a magnetic field. The inductive coupling allows data and power generated by the necklace to be transferred to the contact lens display. A projector in the contact lens display projects images generated from the data onto the retina of the wearers eye.

**23 Claims, 13 Drawing Sheets**

